

Data for Best Viewing of the Planets 2018-2025

April 5, 2018

Traditionally, the best time to view a planet is when it is at opposition – the time when the line from the Sun to the Earth extends closest to the planet. This works well for the outer planets, Mars and beyond.

But, for the inner planets, Mercury and Venus, the traditional event is the time of the greatest elongation or separation (there is a slight difference here). The separation is the angle from Sun-center to Earth-center to planet-center.

However, for an observer on Earth, an inner planet is visible only from the time the sky is dark enough before sunrise after the planet has risen, or dark enough after sunset before the planet sets. The geometry for this is highly dependent on the observer's location. Listed below are the times when the Sun is six degrees below the horizon for an observer at the Hidden Valley Observatory in Rapid City, South Dakota, and when the elevation of Mercury or Venus above the horizon is greater than the preceding and following days. This information is specific to the location, but illustrative of the sad fact that maximum separation does not always equate to a good view. The date and time are in Mountain Standard Time (add one hour when MDT is needed).

The dates and times for the greatest separation, or opposition, are listed in UTC (subtract 7 hours for MST), but typically the view a day or two earlier or later isn't much different. Next, the visual magnitude is listed with 1 equivalent to a bright star, 2 equivalent to a less bright star, and so on. A magnitude of zero, or negative, indicates a greater brightness. A magnitude of 5 or 6 indicates an object that will require a very dark and clear sky, or a telescope. The apparent distance (Earth center to planet center) is listed in Astronomical Units, along with the visual diameter of the planet in seconds of arc ($3600'' = 1 \text{ degree}$).

The declination is listed in degrees as a guide to how favorably the planet will be located in the sky. As a general rule for observers in the Northern Hemisphere, the view of a celestial object is better when the declination is greater, and not so good when it is negative; in the Southern Hemisphere this is reversed.

For the inferior planets Mercury and Venus, the separation angle between the Sun and the planet is listed in degrees, and whether the planet can be viewed in the morning before sunrise, or in the evening after sunset is indicated.

The superior planets (Mars and beyond) are best viewed when at opposition (i.e. when the planet is 180 degrees away from the Sun (as measured in longitude around the celestial equator). At that time the planet is highest in the sky at midnight, and should be above the horizon most of the night (or all of the night).

Mercury highest above horizon at HVO at 6-degree twilight

Date	MST	Elev.	mag.	Decl.	Seprtn
12/28/2017	06:55:01	10.48	-0.28	-20.161	22.1
03/15/2018	18:28:00	11.99	-0.28	7.436	18.4
04/26/2018	04:21:02	2.45	0.50	1.479	26.7
07/02/2018	20:15:39	8.06	-0.02	19.923	24.5
08/28/2018	04:42:00	10.56	-0.47	15.695	18.2
11/10/2018	17:02:18	3.18	-0.20	-24.778	22.7
12/12/2018	06:46:22	11.38	-0.40	-17.617	20.9
02/27/2019	18:07:28	11.50	-0.36	0.456	18.1
04/03/2019	05:02:13	3.35	0.63	-5.583	25.8
06/16/2019	20:14:40	10.17	0.01	23.576	23.9
08/12/2019	04:21:48	9.89	-0.38	19.252	18.7
10/20/2019	17:30:18	2.23	-0.13	-21.050	24.6
11/27/2019	06:31:31	11.86	-0.54	-14.046	20.0
02/11/2020	17:46:20	10.96	-0.43	-6.492	18.1
03/14/2020	05:37:45	4.57	0.52	-11.317	25.3
05/30/2020	20:03:26	11.97	0.05	25.441	23.0
07/26/2020	04:01:55	8.78	-0.32	21.274	19.5
09/24/2020	18:14:15	2.08	-0.04	-12.494	25.0
11/10/2020	06:12:05	11.90	-0.62	-9.201	19.1
01/25/2021	17:25:09	10.19	-0.47	-12.939	18.3
02/25/2021	06:07:27	5.86	0.32	-16.003	25.1
05/14/2021	19:45:25	13.01	0.10	25.142	21.9
07/10/2021	03:44:54	7.18	-0.27	21.500	20.4
09/02/2021	18:56:04	2.64	-0.03	-3.074	24.5
10/25/2021	05:51:45	11.68	-0.66	-3.685	18.4
01/09/2022	17:05:55	9.02	-0.46	-18.432	18.9
02/08/2022	06:32:14	7.17	0.15	-19.251	24.4
04/28/2022	19:24:29	13.20	0.14	22.619	20.6
06/24/2022	03:34:45	5.32	-0.24	19.881	21.3
08/14/2022	19:30:06	3.67	-0.05	5.053	24.4
10/09/2022	05:32:00	11.39	-0.65	2.124	18.0
12/24/2022	16:52:09	7.45	-0.40	-22.543	19.6
01/23/2023	06:48:28	8.50	-0.04	-20.957	23.7
04/11/2023	19:01:54	12.84	0.00	17.794	19.5
06/07/2023	03:35:00	3.57	-0.17	16.122	22.6
07/28/2023	19:55:14	5.08	-0.05	11.683	24.5
09/23/2023	05:12:48	11.11	-0.61	7.836	17.8
12/08/2023	16:47:10	5.69	-0.31	-24.934	20.5
01/07/2024	06:55:36	9.80	-0.20	-20.955	22.7
03/24/2024	18:39:59	12.29	-0.21	11.372	18.7
05/14/2024	03:54:09	2.46	0.16	7.957	25.8
07/10/2024	20:11:44	6.88	-0.07	17.662	24.2
09/06/2024	04:53:36	10.80	-0.53	13.047	17.9
11/20/2024	16:53:11	4.00	-0.24	-25.481	21.8

12/21/2024	06:52:31	10.90	-0.33	-19.301	21.6
03/08/2025	18:19:34	11.77	-0.29	4.597	18.2
04/15/2025	04:39:19	2.75	0.61	-1.772	26.3
06/25/2025	20:16:38	8.95	-0.01	21.598	24.4
08/21/2025	04:33:46	10.32	-0.45	17.339	18.4
11/01/2025	17:12:23	2.70	-0.18	-23.654	23.6
12/05/2025	06:40:28	11.63	-0.45	-16.175	20.5

Venus highest above horizon at HVO at 6-degree twilight

Date	MST	Elev.	mag.	Decl.	Seprtn
05/27/2018	19:59:56	19.78	-3.93	24.850	33.5
12/13/2018	06:47:08	28.22	-4.80	-11.342	44.4
03/24/2020	18:39:58	37.82	-4.49	20.930	46.1
09/06/2020	04:53:32	33.60	-4.24	18.651	44.2
07/15/2021	20:08:15	9.26	-3.87	15.422	29.1
12/05/2021	16:47:19	15.64	-4.88	-23.843	39.1
02/15/2022	06:22:56	17.10	-4.85	-16.816	40.9
07/15/2022	03:49:24	12.68	-3.84	22.615	26.1
05/01/2023	19:28:06	31.42	-4.17	25.752	42.5
10/21/2023	05:46:14	36.14	-4.53	6.895	46.4
02/01/2025	17:34:12	34.32	-4.77	1.223	44.9
08/09/2025	04:23:57	25.09	-3.96	21.926	36.3

Mercury at greatest separation:

Date	UTC	Mag.	Dist(au)	arcsec	Decl.	Seprtn	Type
01/01/2018	19:58:27	-0.35	1.0157096	6.62	-21.080	22.7	Morn.
03/15/2018	15:09:34	-0.34	0.9093770	7.40	7.196	18.4	Evng.
04/29/2018	18:23:45	0.34	0.8398669	8.01	2.361	27.0	Morn.
07/12/2018	05:29:20	0.39	0.8423601	7.99	15.563	26.4	Evng.
08/26/2018	20:34:23	-0.23	0.9158213	7.35	15.809	18.3	Morn.
11/06/2018	15:31:42	-0.26	1.0182788	6.61	-24.278	23.3	Evng.
12/15/2018	11:29:58	-0.47	1.0132915	6.64	-18.415	21.3	Morn.
02/27/2019	01:25:09	-0.51	0.9298750	7.24	-0.128	18.1	Evng.
04/11/2019	19:41:56	0.25	0.8695467	7.74	-4.278	27.7	Morn.
06/23/2019	23:15:40	0.44	0.8250850	8.15	21.253	25.2	Evng.
08/09/2019	23:07:59	-0.03	0.8918176	7.54	19.164	19.0	Morn.
10/20/2019	04:01:45	-0.13	1.0096317	6.66	-20.789	24.6	Evng.
11/28/2019	10:29:14	-0.57	1.0049803	6.69	-14.333	20.1	Morn.
02/10/2020	13:55:56	-0.61	0.9493491	7.09	-7.340	18.2	Evng.
03/24/2020	02:06:21	0.15	0.9059019	7.43	-10.431	27.8	Morn.
06/04/2020	13:07:02	0.43	0.8226089	8.18	24.758	23.6	Evng.
07/22/2020	15:12:09	0.18	0.8660799	7.77	20.725	20.1	Morn.
10/01/2020	16:05:36	-0.02	0.9905179	6.79	-15.733	25.8	Evng.
11/10/2020	17:03:14	-0.62	0.9934060	6.77	-9.256	19.1	Morn.
01/24/2021	01:56:51	-0.66	0.9680114	6.95	-13.974	18.6	Evng.
03/06/2021	11:22:11	0.06	0.9432242	7.13	-15.625	27.3	Morn.
05/17/2021	05:53:38	0.34	0.8335937	8.07	25.247	22.0	Evng.
07/04/2021	19:45:05	0.34	0.8418036	7.99	20.104	21.6	Morn.
09/14/2021	04:24:30	0.08	0.9623061	6.99	-9.567	26.8	Evng.
10/25/2021	05:29:41	-0.64	0.9799881	6.87	-3.584	18.4	Morn.
01/07/2022	11:03:41	-0.64	0.9856182	6.83	-19.552	19.2	Evng.
02/16/2022	21:06:48	-0.04	0.9761771	6.89	-19.462	26.3	Morn.
04/29/2022	08:08:58	0.18	0.8527180	7.89	22.674	20.6	Evng.
06/16/2022	14:55:32	0.43	0.8242026	8.16	17.210	23.2	Morn.

08/27/2022	16:14:19	0.18	0.9279844	7.25	-2.692	27.3	Evng.
10/08/2022	21:13:29	-0.59	0.9650214	6.97	2.306	18.0	Morn.
12/21/2022	15:31:22	-0.57	1.0012365	6.72	-23.576	20.1	Evng.
01/30/2023	05:53:41	-0.16	1.0003808	6.73	-21.604	25.0	Morn.
04/11/2023	22:10:22	-0.02	0.8748156	7.69	17.730	19.5	Evng.
05/29/2023	05:33:52	0.44	0.8186650	8.22	12.362	24.9	Morn.
08/10/2023	01:46:37	0.26	0.8914909	7.55	4.529	27.4	Evng.
09/22/2023	13:15:58	-0.49	0.9480671	7.10	8.045	17.9	Morn.
12/04/2023	14:28:28	-0.46	1.0130064	6.64	-25.609	21.3	Evng.
01/12/2024	14:37:28	-0.28	1.0133209	6.64	-21.832	23.5	Morn.
03/24/2024	22:34:02	-0.23	0.8969768	7.50	11.305	18.7	Evng.
05/09/2024	21:29:19	0.39	0.8280129	8.13	6.215	26.4	Morn.
07/22/2024	06:38:43	0.35	0.8579290	7.84	11.677	26.9	Evng.
09/05/2024	02:30:13	-0.34	0.9284842	7.25	13.229	18.1	Morn.
11/16/2024	08:09:18	-0.34	1.0186454	6.60	-25.411	22.6	Evng.
12/25/2024	02:30:10	-0.40	1.0155953	6.62	-20.160	22.0	Morn.
03/08/2025	06:09:14	-0.42	0.9181850	7.33	4.139	18.2	Evng.
04/21/2025	18:49:03	0.30	0.8512630	7.90	-0.455	27.4	Morn.
07/04/2025	04:38:41	0.41	0.8331304	8.08	18.151	25.9	Evng.
08/19/2025	09:48:01	-0.15	0.9058714	7.43	17.400	18.6	Morn.
10/29/2025	22:02:09	-0.20	1.0157953	6.62	-23.044	23.9	Evng.
12/07/2025	21:02:50	-0.51	1.0102345	6.66	-16.852	20.7	Morn.

Venus at greatest separation:

Date	UTC	Mag.	Dist(au)	arcsec	Decl.	Seprtn	Type
08/17/2018	17:31:12	-4.46	0.6848118	24.37	-5.647	45.9	Evng.
01/06/2019	04:53:39	-4.57	0.6741256	24.76	-16.509	47.0	Morn.
03/24/2020	22:13:34	-4.48	0.7087474	23.55	20.881	46.1	Evng.
08/13/2020	00:14:08	-4.43	0.7075050	23.59	20.030	45.8	Morn.
10/29/2021	20:52:00	-4.54	0.6674576	25.00	-26.943	47.0	Evng.
03/20/2022	09:24:58	-4.52	0.6778399	24.62	-14.899	46.6	Morn.
06/04/2023	11:00:41	-4.43	0.7095703	23.52	22.870	45.4	Evng.
10/23/2023	23:14:28	-4.51	0.6941614	24.04	6.209	46.4	Morn.
01/10/2025	05:01:26	-4.55	0.6827552	24.44	-9.422	47.2	Evng.
06/01/2025	03:28:35	-4.44	0.6998547	23.85	7.693	45.9	Morn.

Mars at opposition:

Date	UTC	Mag.	Dist(au)	arcsec	Decl.
07/27/2018	05:13:20	-2.78	0.3861567	24.25	-25.498
10/13/2020	23:25:54	-2.62	0.4192373	22.34	5.445
12/08/2022	05:41:33	-1.87	0.5495627	17.04	24.995
01/16/2025	02:38:31	-1.38	0.6436723	14.55	25.117

Jupiter at opposition:

Date	UTC	Mag.	Dist(au)	arcsec	Decl.
05/09/2018	00:39:09	-2.52	4.4001548	44.80	-16.071
06/10/2019	15:27:48	-2.62	4.2842328	46.02	-22.438
07/14/2020	07:58:32	-2.75	4.1395031	47.63	-21.909
08/20/2021	00:28:33	-2.88	4.0132089	49.12	-13.545
09/26/2022	19:33:10	-2.94	3.9526443	49.88	-0.019
11/03/2023	05:02:26	-2.91	3.9826438	49.50	13.632
12/07/2024	20:58:01	-2.81	4.0896972	48.21	22.063

Saturn at opposition:

Date	UTC	Mag.	Dist(au)	arcsec	Decl.
06/27/2018	13:28:05	0.02	9.0488217	18.37	-22.454
07/09/2019	17:07:16	0.05	9.0327984	18.40	-22.012
07/20/2020	22:27:48	0.10	8.9947106	18.48	-20.658
08/02/2021	06:14:26	0.19	8.9352982	18.60	-18.440
08/14/2022	17:10:37	0.30	8.8568489	18.76	-15.440
08/27/2023	08:28:05	0.44	8.7630148	18.97	-11.761
09/08/2024	04:35:12	0.61	8.6580736	19.20	-7.530
09/21/2025	05:45:37	0.65	8.5467735	19.45	-2.895

Uranus at opposition:

Date	UTC	Mag.	Dist(au)	arcsec	Decl.
10/24/2018	00:46:26	5.68	18.8752992	3.73	11.140
10/28/2019	08:14:51	5.67	18.8328951	3.74	12.569
10/31/2020	15:52:43	5.66	18.7876670	3.75	13.948
11/04/2021	23:57:14	5.65	18.7391261	3.76	15.271
11/09/2022	08:25:47	5.64	18.6872229	3.77	16.529
11/13/2023	17:20:05	5.62	18.6315285	3.78	17.715
11/17/2024	02:44:11	5.61	18.5722175	3.79	18.818
11/21/2025	12:24:51	5.60	18.5094264	3.81	19.829

Neptune at opposition:

Date	UTC	Mag.	Dist(au)	arcsec	Decl.
09/07/2018	18:27:11	7.82	28.9329242	2.36	-6.799
09/10/2019	07:24:17	7.82	28.9276827	2.36	-5.986
09/11/2020	20:26:15	7.82	28.9224183	2.36	-5.164
09/14/2021	09:21:29	7.82	28.9166208	2.36	-4.333
09/16/2022	22:21:24	7.81	28.9097832	2.36	-3.496
09/19/2023	11:18:00	7.81	28.9018396	2.36	-2.653
09/21/2024	00:17:17	7.81	28.8931656	2.36	-1.807
09/23/2025	12:54:05	7.81	28.8841731	2.36	-0.959

Pluto at opposition:

Date	UTC	Mag.	Dist(au)	arcsec	Decl.
07/12/2018	10:04:08	14.25	32.5830420	0.10	-21.776
07/14/2019	14:51:08	14.28	32.8221633	0.10	-22.073
07/15/2020	19:12:28	14.31	33.0635414	0.10	-22.338
07/17/2021	22:46:17	14.34	33.3067531	0.10	-22.573
07/20/2022	01:38:28	14.37	33.5514770	0.10	-22.780
07/22/2023	03:52:29	14.41	33.7979043	0.10	-22.958
07/23/2024	05:37:44	14.44	34.0465923	0.10	-23.109
07/25/2025	06:32:46	14.47	34.2977483	0.10	-23.234